The Costing of Community Maternal And Child Health Interventions

A Review of the Literature with Applications for Conducting Cost-Effectiveness Studies and for Advocacy

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Executive Summary

This document reviews both the formal and informal "gray" literature covering experiences costing community interventions for maternal and child health care. The review focuses on experiences in sub-Saharan Africa, but also incorporates literature on other regions. The document highlights lessons learned from the existing literature that are pertinent for future work in this area, specifically work related to the costing of the community component of the Integrated Management of Childhood Illnesses (IMCI).

Community-level health care activities are important in sub-Saharan Africa because the coverage of formal health care systems is low. An estimated 40 to 50 percent of the population in the region does not receive formal health care when care is needed, instead self-treating or not receiving care at all. Forty-two percent of children under one year of age do not receive a measles vaccination and 47 percent do not receive the DPT vaccine.

Cost-effectiveness studies for IMCI, both facility-based and community-based, are a research priority since such studies can conclusively demonstrate the efficiency gains resulting from integrating child survival programs. In sub-Saharan Africa, because of the limited coverage of the fixed health care system, IMCI must reach the community and family levels if it is to achieve wide coverage. The *costing* of community IMCI is important for several reasons, including planning, implementation, and advocacy.

The review begins with costing experiences related to maternal and child health care in general, and not just at the community level, since the methodologies used are applicable to community-based costing and the findings are important for comparison purposes. Three major categories of studies are identified: (1) those using predictive costing; (2) those using actual costing; and (3) cost-effective analyses (which can be based on either predictive or actual costing methods). For each category, methodological issues pertinent for costing maternal and child health services are raised.

A considerable amount of work has already been done to measure the costs and benefits of separate child survival programs, especially Control of Diarrheal Diseases (CDD) and Expanded Program on Immunizations (EPI) programs. This work showed both interventions to be efficient; oral rehydration therapy (ORT) costs just \$0.71 per child diarrhea episode treated, and a full series of child immunizations costs between \$5 to \$13, depending on the setting and the mode of delivery. Other studies have shown that measles vaccinations, costing \$140 per death averted, and malaria bednets are highly cost effective.

Interventions employing community health workers (CHWs) and village health workers (VHWs) have also generally been found to be cost-effective. But the same studies show that CHWs and VHWs are not effective if they are not continuously supported with salaries, financial incentives, or some other type of motivation. Services provided by community-based traditional birth attendants are less cost-effective than facility-based services in reducing maternal mortality. Nonetheless, community activities can play a significant role in generating demand for health and family planning services—a factor that is difficult to quantify in the context of cost-effectiveness studies, but still represents an important argument in favor of community activities.

Women's groups also have a large potential as community agents to influence health care behaviors. Where cost estimates exist, women's groups have been shown to be a cost-effective means of promoting public health causes. Other types of community agents employed for health promotion include schoolteachers and theatre groups, but there is little evidence regarding the costs of these types of interventions. Television and radio have been successfully employed to promote child survival programs and practices, but most of the gains in health behaviors achieved through television have been short-term in nature.

In sum, this review shows clearly that community-based interventions can be cost-effective in delivering essential maternal and child health care services. Community interventions reach population groups that are typically beyond the reach of formal health care systems. In sub-Saharan Africa, community interventions are complementary to, and not in competition with, fixed health care systems, adding value and results to facility-based health care.

Very few rigorous cost-effectiveness studies of community interventions have been done to date in sub-Saharan Africa. Additional studies of this nature are an important research priority, to help with promoting the cause of community-based health care and also planning for additional interventions. This document provides an overview of the different manuals and methodologies that are available as tools for measuring both costs and effectiveness measures at the community level. In general, costing studies in sub-Saharan Africa should be kept simple and easily interpretable. It is important to count all pertinent costs, including capital costs and indirect costs such as management, supervision, and administration.

Once these indirect costs are known, it is likewise important to find an appropriate method to allocate them to the services ultimately provided. A simplified version of activity-based costing (ABC), based on interviews or observation of staff time, is likely to be the most practical alternative. Another key implementation issue is to ensure that the relevant benefits of these interventions are included, such as demand creation and improvements in preventive health practices.

For both planning and advocacy purposes, the results of community-level costing studies should be presented in a straightforward and easily understandable manner. Start-up costs and capital costs— to be funded by donors—should be separated from recurrent costs, which are often assumed by ministries of health or by the communities themselves.

1. Introduction – The Context for the Review

This document reviews both the formal and informal "gray" literature covering experiences costing community interventions for maternal and child health care. The review focuses on, but is not limited to, experiences in sub-Saharan Africa. The document presents lessons learned from the existing literature that are pertinent for future work in this area, specifically work related to the costing of the community component of the Integrated Management of Childhood Illnesses (IMCI).

This review begins with a discussion of the importance of community-level costing, including its applications for planning community interventions and for advocacy, showing that community interventions are a cost-effective means of reaching specific population groups that are otherwise unobtainable. The review then briefly presents the community component of IMCI, including a description of the various research efforts in progress that are related to the costing of the community component.

(1) The Importance of Community-Level Costing Community-level health care activities are important in sub-Saharan Africa because the coverage of formal health care systems is low. An estimated 40 to 50 percent of the population in the region does not receive formal health care when care is needed, instead self-treating or not receiving care at all. One study in a Nigerian town (Brieger, Ramakrishna, and Adeniyi, 1986) showed that over 80 percent of the illness episodes over a 12-month period had been managed by the household. In Tanzania, an estimated 40 percent of deaths to children under five years of age occur at home in Dar es Salaam; in the rural district of Morogoro the equivalent figure is 80 percent (MOH Tanzania, 1997).

For the entire sub-Saharan African region in 1993, over 60 percent of births were assisted by a family member, a traditional birth attendant, or by no one at all (Daly *et al*, 1993). In 1997, 53 percent of the population was without access to safe water or sanitation (World Bank, 1999b). Likewise, 53 percent of pregnant women did not receive a tetanus vaccination in 1997. Forty-two percent of children under one year of age had not received a measles vaccination and 47 percent had not received the DPT vaccine (World Bank, 1999a).

Cost-effectiveness studies for IMCI are a research priority since such studies can conclusively and scientifically demonstrate the efficiency gains resulting from integrating child survival programs (WHO, 1998a). But in sub-Saharan Africa, because the fixed health care system only reaches approximately half of the population, IMCI must reach the community and family levels if it is to achieve wide coverage. The *costing* of community IMCI is important for several reasons, including planning, implementation, and advocacy.

For planning and implementation, it is essential to know what are the necessary inputs into community-level interventions and how much these inputs and interventions actually cost, in order to budget activities funded by ministries of health and donors. Cost and cost-effectiveness studies of community interventions are also a primary tool for advocacy—promoting these interventions and gaining financial support for them. If costing studies are accurately carried out and can show that community interventions deliver essential services to specific populations for less money than the fixed health care system, these studies will represent fundamental evidence supporting arguments for community interventions. When promoting community-level interventions to donors, it is important to differentiate

between intervention start-up costs, typically assumed by donors, and ongoing recurrent costs that are paid by ministries of health or the communities themselves.

As this review shows, the line between community and facility-based interventions is often a fuzzy one: many community health agents are in fact based at health facilities or receive some support from the health system. For this reason, and because many of the techniques used to cost facility-based interventions are also applicable to community interventions, this review provides an overview of techniques used to cost primary health care activities at health facilities as well as those activities that are strictly community-based.

Practical approaches to designing and costing community interventions are clearly important to the overall success of IMCI. But not much agreement exists even on how to characterize community interventions, and, as this review shows, there is limited practical experience with costing interventions that directly target households through mechanisms readily available in the community. This document identifies and categorizes community channels that can be used to improve maternal and child health care practices, and represents a first step towards the development of a practical methodology for costing out interventions that employ these channels.

(2) Costing Community IMCI – Work Underway The overall IMCI strategy has three principal components: (1) the improvement of health systems; (2) the improvement of health worker skills; and (3) the improvement of family and community practices. The component for the improvement of family and community practices seeks to initiate, reinforce, and sustain family practices that are important for child survival, growth, and development (WHO, 1998b).

Major research efforts that include components related to costing community IMCI are currently underway or are planned for the near future. The Department of Child and Adolescent Health and Development (CAH) of WHO is currently coordinating a multi-country evaluation of IMCI (MCE) in collaboration with technical partners. This study is taking place in Tanzania, Uganda, and Bangladesh. The MCE will document the costs of implementing IMCI at the household, health facility, and district levels.

The WHO/CAH department is also supporting the development of the IMCI costing model; a tool for planning and costing out the implementation of IMCI at the national, regional, and district levels. The costing model proposes methodologies and spreadsheets for costing the various components of IMCI, including training, drugs, and other treatment costs. The model separates start-up costs from treatment costs. It uses a demographic and epidemiological approach to establish what are the likely caseloads for specific diseases in a given country or setting, and therefore what will be the costs associated with treatment. Plans are being made to introduce a community component into the IMCI costing model—a tool to determine the probable resource requirements and costs of extending IMCI beyond the health facility and into the community.

At the same time, the BASICS project, supported by USAID, is developing an instrument to carry out assessments of community child health interventions at the district and national levels. This instrument will be used as a planning tool for community child health interventions and will include a costing component, although not as detailed as that developed in the WHO costing model.

2. Definitions and Framework

This review discusses methodologies and experiences related to the costing of community health interventions—specifically interventions to improve the health of women and children. There is a potentially confusing variety of terms related to community interventions and their implementation, this section, therefore, defines these terms within the context of this review.¹

Interventions are a set of programmatic activities designed to change behaviors or practices. Specifically, community health interventions seek to change households' and communities' behavior related to the prevention of disease, the provision of health care at the home, or care-seeking outside the home. UNICEF (1999) and WHO (1998b) have defined 12 key family health practices. These practices can and should be targeted by IMCI community interventions, both because they have great public health implications and because they can feasibly be changed. They are:

- 1. Exclusive breastfeeding for children from four to six months of age.
- 2. Appropriate supplementary complementary feeding practices for children beginning at four to six months.
- 3. The provision of micronutrients to children, including increased vitamin A through diet or supplementation. (The first three family practices are directly related to childhood nutrition: malnutrition is associated with more than 50 percent of childhood deaths.)

- A full course of immunizations for children before their first birthday, including BCG, DPT, OPV, and measles. Universal coverage for the measles immunization alone could prevent an estimated 800,000 deaths per year.
- 5. Use of bednets treated with insecticide, bednets could reduce child deaths due to malaria by over 20 percent.
- 6. Appropriate attention to the mental and social development of the child.
- 7. Feeding and giving fluids to sick children. Correct home care for diarrhea can prevent nearly all of the 1.2 million child deaths each year caused by acute watery diarrhea.
- 8. Appropriate home treatment for infections.
- 9. Recognizing signs indicating that a child's illness is serious enough to warrant treatment outside the home.
- 10. Following health workers' recommendations for treatment, follow-up, and referral.
- 11. Washing hands, and properly disposing of feces. Improved hygiene practices can reduce the incidence of diarrhea by more than 10 percent.
- 12. Appropriate prenatal care for mothers, including the tetanus immunization.

An additional feature of community health interventions as defined here is that they use community *channels* to influence behaviors or practices. Community channels are individuals or other influences that have regular contact with households, including parents and children, but are external to the formal health care delivery system. For example, health education in schools is a community intervention, while the schoolteachers themselves are a channel. *Tools* are materials used to facilitate

communication between channels and households. Following the same example, print materials used by schoolteachers in communicating with children are considered to be tools.

Health education in health facilities, although extremely important, is not considered as a community intervention since it is a part of the formal health system. However, the use of community-based health workers to communicate with households is considered a community intervention. Moreover, interventions using media such as radio and television are considered to be community interventions since the channels involved, radio or television, are found in most communities and many households have daily contact with these channels.

3. Overview of Costing Methodologies and Experiences

This section of the review deals with costing methodologies and experiences that are pertinent for costing maternal and child health care services in general, and not just for community interventions. The following section, "Specific Experiences in Costing Community Interventions," deals directly with community interventions.

Shepard (1984), reviewing costs for Control of Diarrheal Diseases (CDD) programs, found two ways to develop cost estimates: (1) using a predictive model for a hypothetical or proposed program; and (2) analyzing actual costs from a real program. Predictive models identify the types and amounts of resources that would be required for a program based on disease incidence, treatment patterns, and the unit costs of inputs. At an operational level, predictive models are useful for planning new programs, when relevant data on actual costs are limited or absent. But Shepard found that the assumptions underlying predictive models are generally

optimistic, costs and numbers of persons treated turn out to be less favorable than projected. On the other hand, only a limited number of studies of the actual costs of maternal and child health care programs exists, and the data for these studies are often not representative of what they would be in larger scale programs.

This review follows Shepard in splitting costing experiences in the literature between *predictive costing* and *actual costing* experiences. This document adds a third major category, *cost-effective analysis*, which can use either predictive or actual costing methods. For each category, methodological issues pertinent for costing maternal and child health services are raised.

A. Predictive Costing

One approach to predictive costing looks to calculate the costs of offering a "basic package" of health care services, generally at the health district and health facility level. Some definitions of the basic package also include community services, organized at either the district or health facility level, while others do not. Basic package models suffer from two principal disadvantages from the perspective of costing out community interventions. Firstly, basic package estimates generally do not include training and other start-up costs associated with the implementation or expansion of an intervention; they reflect only the ongoing operational costs. Secondly, the resulting service delivery costs calculated are minimum costs, calculated under assumptions of peak efficiency that rarely hold in an operational context.

The World Bank's 1993 document *Better Health in Africa* calculated that a facility-based basic package of health services could cost as little as \$13.22 per capita per year in low income African countries if resources were efficiently allocated. Of this amount, \$7.74 would be spent at the health facility level; \$3.98 on intersectoral interventions, including safe drinking water and

sanitation; and \$1.50 on institutional support, including a district health care management team, a national management structure, and initial training. Viewed as outputs, the basic package would cost \$0.47 per capita for maternal health services including nutrition, \$0.21 per capita for a school children health program, and \$1.52 for well baby services. The same package would cost an estimated \$16 in a high income country in Africa.

Additional detailed cost estimates for a facility-based basic package of services are available from recent work by the World Bank and the Partnerships for Health Reform (PHR) project in Egypt. Using an epidemiological and demographic model, based on known disease prevalence and incidence and targeted coverage rates, the World Bank estimates the cost of a package of services, including family planning, reproductive health care, and basic ambulatory care, to cost 58.7 Egyptian Pounds (approximately \$17.80) per capita per year.² PHR (1999) has produced separate estimates of between 48 and 60 Egyptian pounds (approximately \$16 to \$20) per capita for a similar package.³

Lissner and Weissman (1998) prepared a spreadsheet to cost out a package of interventions designed to reduce maternal and neonatal mortality in developing countries (called the Mother-Baby Package). The spreadsheet can be used for costing and planning purposes at the national or district level. The methodology used to cost the Mother-Baby Package, using inputs for the specific interventions calculated on an aggregate level, with quantities based on demographic and epidemiological profiles, provides a basis for the IMCI costing model. Among basic packages that include a community component, Cornia (1983) estimated the cost of a complete minimum package of child survival services to be \$25 to \$30 per child annually.

Predictive Community Costing in Tanzania

There are few experiences with predictive costing interventions that are entirely community-based. Many costing experiences related to community interventions are actually budgeting exercises – typically prepared for submissions of proposals and project preparation documents. One such budgeting experience from Tanzania costs out an intervention to provide primary maternal and child health services, and health care promotion, at the district level. The intervention involves several channels, including community health workers (CHWs), drug vendors and shops, and extension workers from hospital wards. The approaches taken include:

- > Training of a 15 person multi-sectoral team at the district level;
- Training of 100 ward extension staff;
- Training of CHWs and Traditional Birth Attendants (TBAs);
- Training of dispensers and shopkeepers;
- > Orientation and sensitization of village leaders;
- Orientation of village health committees;
- Social marketing of bednets;
- Qualitative research to orient IEC messages and materials.

Under this model, community health workers are provided with basic supplies and essential drugs, including chloroquine, oral rehydration salts (ORS), cotrimoxazole, Vitamin A, eye ointment, and a portable weighing scale. TBAs have ORS, condoms, a delivery kit, and iron. Transportation is based on bicycles, the costs of which are included in the intervention. The total cost of such an intervention, including start-up training costs, is calculated at \$126,200, or \$0.84 per capita per year in a district with 150.000 inhabitants.

Source: This example is based on work carried out by Dr Suleiman Kimatta, UNICEF/Tanzania, and Dr. Suzanne Prysor-Jones in Tanzania, April, 1999.

B. Actual Costing

(1) Methodological Issues

There are two major challenges in calculating the unit costs of health services, whether they are offered at a health facility or in the community. One is to ensure that all pertinent costs are counted, including capital costs and indirect costs such as management, supervision, and

administration. Likewise, maintaining buildings and equipment are often overlooked in costing studies, as are utilities such as electricity and water, and supplies that are used in common by multiple services. Once these indirect costs are known, the second major challenge is to find an appropriate method to allocate them to the products and services delivered at the health facility or in the community. Different approaches to these challenges are presented in the examples outlined below.

A separate issue is the source of data for cost estimates. In general, actual expenditure data are greatly preferred to budget data, since in many cases budgeted amounts do not correspond to that which is spent. This is particularly true when conducting cost-effectiveness analysis. However, it is possible to estimate the unit costs of community programs using budget line items, categories and numbers of staff, and the numbers of individuals benefiting from various services. Wray (1994)—documenting the costing of community child survival activities supported by World Vision in Maharashtra, India—finds that cost estimates derived in this way, with the help of a pocket calculator, are reasonably close to other, more sophisticated estimates.

(2) Manuals

At least two practical manuals are available to guide the calculation of actual program costs at the level of the health district, health facility, and community. The costing methodologies that they describe are useful and pertinent for the costing of community-level maternal and child health care interventions. One is from UNICEF (Hanson and Gilson, 1993) and the other from WHO (Creese and Parker, 1994). The UNICEF manual *Cost, Resource Use and Financing Methodology for Basic Health Services – A Practical Manual*, defines a basic service package and provides guidelines for costing of

district health services. The basic package of services at the health clinic level includes community outreach visits by the clinic staff who provide growth monitoring and immunization services. This manual provides detailed instructions for calculating the costs of the following inputs that are related to the implementation of community interventions:

- Personnel—including take-home pay, taxes, fringe benefits, and non-monetary benefits.
- Essential drugs—calculated using UNIPAC (UNICEF-Copenhagen) or IDA prices.
- ➤ Medical supplies—including transportation.
- Vehicle operation and maintenance—including fuel, oil, insurance, registration, tires, batteries, and spare parts.
- Vaccines—calculated at UNIPAC prices plus 30 percent for freight.
- Contraceptives.
- Food.
- ➤ Food supplements—using prices from the World Food Program (WFP).
- Community health worker (CHW) kits—calculated based on district-level delivery records and discussions with district coordinators.
- > In-service training.

The UNICEF manual suggests that indirect costs be allocated to the various services delivered using straightforward techniques, including allocation based on the distribution of staff time (calculated either through interviews or direct observation). Maintenance and cleaning costs are allocated according to the physical space taken up by the services delivered, and supplies are allocated according to actual usage. To calculate capital (non recurrent) costs, the manual provides useful life estimates for buildings (20 to 30 years), furniture (10 years), equipment (5-10 years), and vehicles (3-5

years). Among these capital costs, vehicles are the most likely to be pertinent for community interventions. The UNICEF manual does not directly cover the costing of activities led by community groups, or the supervision of these groups. Nevertheless, many of the methodologies proposed in this manual are pertinent for costing community interventions.

Creese and Parker (1994) prepared a basic manual for costing facility-based primary health care services, entitled *Cost Analysis in Primary Health Care – A Training Manual for Programme Managers*. This manual includes guidelines for calculating costs related to the start-up and expansion phases of interventions, including training costs. Other costs pertinent to community interventions are addressed, including methods for calculating the recurrent costs of drugs, vaccines, syringes, supplies, vehicles, bicycles, and social mobilization activities. The manual discusses the calculation of annualizing factors for depreciating capital costs, also pertinent for community interventions.

(3) Estimates of Unit Costs

There are only a limited number of studies available that calculate the actual unit costs of community maternal or child health interventions (these are described in Section 5, "Experiences in Costing Community Interventions").4 But in the 1980s, a considerable amount of work was done to cost vertical child survival programs, especially Control of Diarrheal Diseases (CDD) and Expanded Program on Immunizations (EPI) programs. This work is pertinent for the costing of community interventions since the CDD and EPI programs included community components and many of the methods used to cost these programs are applicable also for community-level activities. Moreover, much of the work done in the 1980s provides baseline figures for comparing the costeffectiveness of community programs with facility-based alternatives and campaigns.

Shepard (1984), referred to above, provided an overview of costing experiences for CDD programs. Brenzel and Claquin (1994) reviewed approximately 30 published and unpublished EPI cost-effectiveness studies conducted during the 1980s. At an average cost of \$5 to \$10 per child,⁵ they found immunizations through the EPI to be one of the most cost-effective child survival interventions. An earlier study by Brenzel (1989) found that when all donor contributions, vaccines, syringes, cold chain equipment, vehicles, and local training costs are included, the average cost per per fully immunized child was \$13. Costs were lower when vaccinations were delivered through fixed facilities (\$11.74 on average), and higher when they were offered through campaigns (\$15.62 on average).

(4) Activity-Based Costing

Activity-based costing (ABC) provides a systematic approach for allocating indirect costs to products and services. While traditional accounting methods allocate overhead and indirect costs on the basis of units of production, ABC first defines the principal activities within an organization, and allocates costs first to activities, and then from activities to products and services. Because of economies of scale in production, traditional accounting tends to attribute too high a cost to high-volume products, and too low a cost to low-volume ones (Chan, 1993). ABC more logically attributes support costs based on the actual consumption of these costs (Cokin, 1996).

ABC allocates indirect costs that are related to supporting personnel (which generally make up the majority of indirect costs in health care) according to the actual time that personnel spend on activities. Time distribution is determined through interviews with personnel, who themselves define the principal activities on which they

work. For community interventions, information related to the costs of the different activities performed by community health workers can be established by direct observation of these activities, or from logbooks maintained by the workers themselves (Janowitz *et al*, 1996).

Waters and Santillan (1999) applied activity-based costing on behalf of MaxSalud, a non-governmental health care provider in Peru. In a small network of two clinics and one management support unit, this study systematically traces MaxSalud's costs, including all the administrative costs associated with the management unit, to the services delivered by the organization.⁶

(5) Costing IMCI

Two major efforts to establish the cost of IMCI services—the WHO multi-country evaluation (MCE) and the IMCI costing model—are described in the introduction to this document. Previous work related to costing IMCI has focused on the actual or potential savings resulting from integrating child survival interventions. In Bangladesh, Amin *et al*, (1998) found that the cost of drugs used in treating child diarrhea and acute respiratory infections (ARI) decreased with the implementation of IMCI. Drug costs for diarrhea declined by 17 percent, and ARI drugs costs by 52 percent. Based on work in Uganda, Kolstad *et al*, (1998) found that IMCI prescription guidelines could potentially reduce pharmaceutical costs by more than 50 percent.

There are mixed findings concerning whether or not health workers spend more or less time with sick children under IMCI than they did before. Burnham (1997) found that the complexity of the IMCI algorithm has increased the average amount of time that health workers spend with children. But Kelley (1999b) shows that, in Niger,

the amount of time per patient does not increase when IMCI procedures are properly followed. Moreover, he finds that IMCI can rationalize drug use and result in lower costs for drugs: with health worker compliance with treatment algorithms near 100 percent, drug costs can be reduced by up to 59 percent from levels prior to the implementation of IMCI.

C. Cost-Effectiveness Studies

Cost-effectiveness studies compare the costs of two or more programs or interventions, using a standardized measure of effectiveness. For example, in the work by Brenzel (1989) cited above, the costs of offering immunizations through fixed facilities are found to be lower than the costs of immunizations delivered through campaigns. For both types of intervention, the unit cost is calculated using the same denominator, a fully immunized child. Cost-effectiveness studies can be carried out using either actual interventions (as with the studies reviewed by Brenzel) or predicted costs. Many cost-effectiveness studies of maternal and child health care interventions compare actual interventions; for example, comparing the measles vaccination to breastfeeding promotion as a means of preventing childhood diarrhea episodes. Other studies compare separate channels for implementing the same intervention; such as facility-based delivery of vaccinations compared to mobile vaccination teams. Cost-effectiveness studies that compare community-based approaches to noncommunity approaches are discussed in the next section of this paper.

A major methodological issue in measuring the costeffectiveness of health interventions is that there are often costs associated with an intervention that are not directly borne by the implementing agency, and are therefore difficult to track. In theory, all of the costs of factors influencing the measure of effectiveness should be included in order for cost-effectiveness comparisons to be valid. Barberis and Harvey (1997) calculated the costs of family planning service delivery in 14 developing countries. They determined costs by using records of actual expenditures and budget allocations where possible, and by estimation in other situations. They included costs financed by donors, often overlooked in costing studies, and they used couple years of protection (CYP) as a standardized measure of effectiveness for comparing service delivery options. But they were unable to measure the costs of several factors that can influence CYP, including nonspecific health care training, research and evaluation, data collection, and general health education efforts.

Likewise, there are often benefits of the intervention that the effectiveness measure does not capture. Phillips, Feachem, and Mills (1987) led a major study of the cost-effectiveness of different interventions to prevent and treat childhood diarrhea. They measure costeffectiveness expressed in terms of the cost per diarrhea episode averted or per death averted, but point out that these measures are not always an accurate indicator of the relative overall efficiency of alternative strategies.

A related issue involves the assumptions necessary to establish a cause-and-effect relationship between the intervention and the outcome. Phillips *et al*, (1987) do this in a systematic way, but one that is still based on a series of assumptions. For example, to calculate the effectiveness of televised health education messages, they assume that a certain percentage of the population sees the message, that a smaller percentage remember it, and an even smaller percentage apply it. The numbers of cases of diarrhea prevented among children under five years old, and the number of deaths averted among this age group, are therefore calculated based on the presumed efficacy of the program.

For the different interventions, Phillips *et al*, found the following median costs in terms of effects on incidence and mortality:

	Median Cost (in 1982 US dollars) of:		
Intervention	Averting a Diarrhea Episode Due to Diarr or Dehydrat		
Measles vaccination	\$7	\$140	
Rotavirus vaccination	\$5	\$220	
ORT	-	\$220	
Hygiene promotion	\$10	-	
Breastfeeding promotion	\$45	\$1,000	
Cholera vaccination	\$174	\$2,000	
Improved weaning practices	-	\$1,070	

Lerman, Shepard, and Cash (1984) conducted a CDD cost-effectiveness study in Indonesia with actual cost data. They compared intervention areas, with relatively high oral rehydration therapy (ORT) use rates, to a control area where no CDD program existed. In the intervention areas, CDD activities included case management using ORS and antibiotics, hospital care where necessary, and health education for parents concerning the use of ORS and homemade sugar-salt solution. Overall, this package of activities cost \$1.14 per child per year on average, or \$0.71 per child diarrhea episode treated with ORT. The average cost of the intervention per death averted was \$212, similar to the estimate of Phillips *et al*, for the cost-effectiveness of ORT interventions. Lerman, Shepard, and Cash also suggest that cost-effectiveness studies can be efficiently conducted when the collection of cost data is standardized and carried out on a regular basis, and when the data are collected by trained program managers and not outside consultants.

Goodman, Coleman, and Mills (1999) have prepared cost-effectiveness estimates for interventions to prevent and treat malaria, using gains in disability-adjusted life years (DALYs) as the measure of effectiveness. For prevention of childhood malaria, they found the treatment of existing bednets with insecticide to be on average the most cost-effective intervention; costing just \$4 to \$10 per DALY gained in a very low-income country. Akhavan *et al*, (1999) studied the cost effectiveness of the national malaria control program in Brazil from 1989 to 1996. The program cost \$69 per DALY gained, and \$2,672 per life saved. Other estimates of cost-effectiveness of child survival interventions have found estimates of \$2 to \$17 per DALY gained for measles vaccination, and \$41 to \$408 for ORT (Jamison *et al*. 1993).8

D. Experiences in Costing Community Interventions

In this section of the paper, community interventions are organized by the types of *channels* that they use, to easily classify and compare interventions. Within the types of channel, interventions are also characterized by the disease control program that they are part of, or the type of behavior that they are trying to influence. The review of formal and informal literature revealed the following major categories of channels for community interventions:

- ➤ Health workers working outside of health facilities and within communities. This wide category of channels includes community health workers (CHWs), village health workers (VHWs), traditional birth attendants (TBAs), and traditional healers.
- Women's groups and other community groups.
- Schoolteachers.
- Theater.
- Mass media, including radio and TV.

In addition, there are *tools*, particularly print materials such as informational flyers, that are common to several of the channels mentioned above. The costing of such tools is therefore addressed separately in this section. Likewise there are specific *activities* common to the different channels, especially participatory research.

(1) Community Health Workers and Other Community Agents

Interventions employing community health workers (CHWs) and village health workers (VHWs) have generally been found to be cost-effective. It is clear, however, that CHWs and VHWs are not effective if they are not continuously supported with salaries, financial incentives, or some other type of motivation. Berman

Cost-Effectiveness of IMCI

Cost-effectiveness studies for IMCI are a research priority since such studies can conclusively and scientifically demonstrate the efficiency gains resulting from integrating child survival programs (WHO, 1998a). There are in fact many ways in which the cost-effectiveness of IMCI could be expressed. Hill *et al.* (1999) discuss methods for measuring the technical efficacy of IMCI preventive interventions. They present a preliminary table with interventions on one axis – including:

- Breastfeeding promotion;
- Complementary feeding;
- ➤ Vitamin A supplementation;
- ➤ Measles immunization;
- > Zinc supplementation;
- ➤ Insecticide-impregnated bednets;
- Deworming;
- Controlling indoor air pollution;
- > Rotavirus vaccine;
- ➤ Hepatitis B vaccine;
- > Pneumococcal vaccine.

The other axis contains the following categories for measuring the effectiveness of each intervention: (1) total mortality; and mortality resulting from: (2) diarrheal diseases; (3) acute lower respiratory infections (ALRI); (3) malaria; (4) measles; and (5) malnutrition. If the total costs of the interventions can be established in addition to the number of lives saved by each, then cost-effectiveness ratios, measured in terms of costs per life saved, can be calculated in a straightforward manner.

(1989), working in the Central Java Province of Indonesia, compared the costs and effectiveness of community health workers, small rural health facilities, and larger health centers. He found that community health workers delivered maternal and child health services, as well as family planning services, more cost-effectively and more equitably than either the health centers or the rural health sub-centers.

In Zambia, community health workers providing direct home care for patients infected with human immunodeficiency virus (HIV) have been shown to be more cost-effective than hospital-based care. Martin et al, (1996) studied the costs of six such programs, out of 40 active in Zambia. Each home visit cost an average of \$2.00 compared to \$4.08 for a one-day hospital stay. The authors also found a 40 percent reduction in total costs for eligible hospital patients referred to home-based care, compared to similar patients who were not referred.

Likewise, an intervention in Anambra State, Nigeria, successfully engaged community health workers to prevent maternal mortality by improving community awareness to facilitate referrals for complicated pregnancies (Nwakoby *et al*, 1997). A group of 48 CHWs received 35 hours of training and then provided education within their communities concerning the risks of complicated pregnancies. They contacted pregnant women in their communities, referred complicated cases, and acted as liaisons between health facilities and the families. The total direct cost of this intervention was just \$625. The intervention did not provide for supervision or for incentives for the CHWs.

On the other hand, services provided by communitybased traditional birth attendants appear to be less costeffective than facility-based services in reducing maternal mortality. Harnmeijer (1990) estimates that for TBAs to provide effective prenatal, natal, and antenatal care in western Zambia, two TBAs would be needed for each 250 people. The costs of training the TBAs would be just \$0.15 (1986 dollars) per inhabitant if a CHW worked in the same area, and \$0.24 if not. However, recurrent costs associated with the TBAs' activities would be significantly higher. A study of different options to reduce maternal mortality found that investments in health centers and rural hospitals were more costeffective than TBAs, even when the TBAs receive specialized training. The study, conducted by the Prevention of Maternal Mortality (PMM) program at Columbia University, compared program investment options including TBAs, prenatal care, family planning, and different levels of health facilities. Using predictive costing techniques, the study found investments in health centers and rural hospitals to be the most cost-effective option (WHO, 1992). ⁹

Similarly, cost-effectiveness studies from the family planning literature have found that community-based distribution techniques are not as cost-effective as other types of service delivery. Barberis and Harvey (1997) studied the cost-effectiveness of options for providing contraception in 14 developing countries, using couple years of protection (CYP) as a standardized measure of effectiveness. The service delivery options included sterilization, other clinic-based services, community-based distribution, and contraceptive social marketing. Clinic-based sterilization proved to be the most cost-effective option, measured in terms of CYP provided. Contraceptive social marketing was the next most efficient option, followed by clinic-based services and community-based distribution.

However, community distribution can play a significant role in generating demand for family planning services. Phillips et al, (1996) found that the contraceptive prevalence rate in Bangladesh would be 25 percent, rather than the actual 40 percent, if not for community outreach and distribution programs. This aspect of community-based programs—that they can raise demand and contribute to overall utilization rates for the health system—is a very important argument in their favor. Unfortunately, demand creation is difficult to measure in the context of cost-effectiveness studies. In the absence of financial incentives and other kinds of support, community and village health workers have generally performed poorly. A review of interventions to promote behavior change for child survival (Graeff and Waters, 1995) found that CHWs, including paid

village health workers and volunteers, must receive encouragement and support in order to continue beyond the months immediately following training. The most important types of support for CHWs are continued training, supervision, adequate supplies, and especially recognition and encouragement from the health system and from the communities in which they work.

Likewise, programs to work with traditional healers in sub-Saharan Africa have had limited success, despite the considerable potential of this group to influence health behaviors. The cost-effectiveness of such programs has been low because of the absence of continued incentives for the healers (USAID, 1996). An exception to this pattern is a study by Hoff (1997) in Ghana, Mexico, and Bangladesh, that showed that traditional healers and TBAs could be effectively trained. The training costs were low; \$98 per healer and from \$40 to \$95 per TBA. Community health practices improved in all of the sites studied, but neither recurrent costs nor quantitative measures of effectiveness were available. This intervention did encounter some difficulties, including the low level of literacy of the traditional healers and the need to develop special training materials and methods.

(2) Women's Groups and Other Community Groups

Women's groups are common in sub-Saharan Africa: they are generally based in the community and organized to pool financial resources that can be used by members for social occasions or for emergencies. Although these groups have a large potential as community agents to influence health care behaviors, this potential remains largely unexploited (Diene, 1993). One example of their involvement comes from Pagnoni *et al*, (1997), who describe the involvement of women's groups in a malaria control program in the rural province of Sourou in Burkina Faso. The program provided basic training

in diagnosing malaria to a core group of mothers in each village in the intervention area. CHWs, supplied with anti-malarial drugs, provided follow-up treatment. The program was judged to provide early treatment for child malaria episodes successfully.

Where costs estimates exist, women's groups have been shown to be a cost-effective means of promoting public health causes. Barzgar *et al*, (1997) describe an intervention in Pakistan to recruit and train women in three rural districts to deliver primary health care services and to promote health-seeking behavior. The women worked within a limited geographic area (generally 1,000 to 1,500 people), and made home visits to provide health promotion, case management, and family planning services. They were provided with supervisory and managerial support.

A year after implementation, the infant mortality rate in the intervention areas had decreased from 130 to 64 per 1,000, and the maternal mortality rate had decreased from 596 to 246 per 100,000. The overall cost of this program was \$386 per woman trained. The annual recurrent costs associated with its continued operation of the program were estimated to be \$1.13 per person living in the intervention areas, with annual capital costs costing an additional \$0.39 per capita. These costs compare favorably with the predictive costing estimates, described above, of delivering similar services as part of a facility-based package of basic health services.

(3) School-based Interventions

Schoolteachers represent another type of community agents employed to promote health interventions. For example, Pillsbury (1990) studies school-based programs for malaria control in Kisumu, Kenya and Danfa, Ghana. These programs resulted in a significant decrease in malaria infection in the group of children exposed to the program compared with a control group.

Smith *et al*, (1993) reviewed school-based programs designed to lower HIV transmission rates. They found that schoolteachers had only been involved in short-term interventions, with little or no documentation of successful use of schools for long-term behavior change and maintenance. Their recommendations for making the programs more effective include: providing feedback to both teachers and children; making the activities routine; and finding ways of encouraging children to pass messages on to their parents.

But there is very little documentation of the costs of school-based programs in developing countries. One study in Tanzania looks at the costs of school-based treatment of urinary schistosomiasis and intestinal nematodes with appropriate drugs. The cost per child treated for schistosomiasis was just \$0.23, and \$0.79 per child treated for intestinal nematodes, and 81 percent of these costs were for the purchase of the drugs.

(4) Theater

Theater groups have been used to transmit public health messages in sub-Saharan Africa, but very little documentation is available concerning their effectiveness. In Zambia in 1992-93 the PRITECH project engaged two local theater groups to perform plays promoting ORT. The plays reached an estimated 80,000 people—mostly woman and children—and recorded a performance for radio broadcast. The total cost of the intervention was less than \$5,000, or \$0.06 per person reached (Freund and Phiri, 1993). But no estimate is available of the effectiveness of the program in terms of the percentage of individuals who retained and acted upon the key health promotion messages.

(5) Mass media

Television has been successfully employed to promote child survival programs and practices. But gains in health behaviors achieved through television promotion have proven to be short-term in nature; people tend to return to earlier behaviors if the message is not constantly reinforced. In the Philippines, television was successfully employed as part of an immunization campaign in metro Manila in 1988 and nationwide in 1990. Face-to-face communication by facility-based health workers complemented and supported the television campaign. The 1990 campaign lasted six months and resulted in an increase in complete immunization coverage for 9- to 11- month olds from 33 percent to more than 56 percent (de Guzman *et al.*, 1992).

In Egypt, 95 percent of the population has access to TV, and 90 percent watch a TV series each night, making television spots and series some of the most costeffective ways to deliver health education messages (Elkamel, 1995). But the experience of the National CDD Program there shows that individual television campaigns alone cannot bring about sustained, long-term behavior change. An intensive television campaign to promote ORS in 1984 and 1985 resulted in very high rates of recognition (96 percent), use (82 percent) and correct preparation (97 percent) among mothers interviewed by an evaluation team. But these gains proved to not be sustainable, and the ORT-use rate had decreased to 34 percent by 1992 (USAID, 1987; UNICEF, 1994).

Radio is the most practical mass media channel in sub-Saharan Africa. In rural Nigeria, 75 percent of the population listens to the radio, while 48 percent occasionally watch television, 29 percent read a newspaper, and 19 percent read magazines. In Swaziland, a Healthcom study found that radio was able to reach 62 percent of the population, while outreach workers were in contact with only 16 percent (Brieger, 1990). But while short-term radio campaigns have been

widely used to change health behaviors, the literature shows little evidence that radio has successfully supported behavior changes over the long term in sub-Saharan Africa.

In a cost-effectiveness analysis, Vincent (1997) found mass media to be more efficient than community health workers. But in general limited information is available about the costs of mass media interventions. Because of the multiple sources of costs involved—including ministries of health, state-owned media organizations, private ad development agencies, and donors—it is difficult to identify the full cost of such interventions. Phillips, Feachem, and Mills (1987) estimated that mass media health promotion activities generally ranged from less than \$20,000 to over \$500,000 per campaign. At the most expensive extreme, a national breast-feeding mass media campaign in Brazil cost over \$3 million. But no documented cost-effectiveness studies exist of mass media activities in the context of regular, on-going health promotion, as opposed to campaigns.

(6) Costs Common Across Approaches

Participatory research to guide the design of health education messages is an essential activity common to health interventions employing several different types of channels, including mass media and, often, community health workers. But few estimates are available of the cost of surveys and focus group research in the context of ongoing health promotion programs. Doherty and Price (1997) reviewed primary health care programs in rural South Africa. They found that participatory research represented 14 percent of the total direct and indirect program costs.

Similarly, print materials have been used as a tool to aid health promotion activities through different channels. In an example from Cameroon, the National CDD Program developed flyers describing the preparation of ORS and the "danger signs" of dehydration that justify taking a child to a health facility. These flyers were distributed in health facilities and by a variety of community health workers, including social development workers and agricultural extension agents. A follow-up study (Hyslop, Herman, and Waters, 1993) found that the materials had little impact on mothers unless accompanied by explanations from knowledgeable personnel. Two conclusions of the study are that: (1) useful educational materials are necessary for effective personal counseling; and (2) training facility-based and community health workers in health education techniques is more cost-effective than producing health education materials for mass distribution. ¹⁰

4. Conclusions

This review shows clearly that community-based interventions can be cost-effective in delivering essential maternal and child health care services. Community interventions reach population groups that are typically beyond the reach of formal health care systems. Moreover, such interventions have additional benefits, such as raising the demand for and utilization of facility-based services, that are not easily measurable in the context of cost-effectiveness studies. In sub-Saharan Africa, community interventions are complementary to, and not in competition with, fixed health care systems, adding value and results to facility-based health care.

Very few rigorous cost-effectiveness studies of community interventions have been done to date in sub-Saharan Africa. Additional studies of this nature are an important research priority—to help promote the cause of community-based health care and also plan for additional interventions. This document provides an overview of the different manuals and methodologies

that are available as tools for measuring both costs and effectiveness measures at the community level. In general, costing studies in sub-Saharan Africa should be kept simple and easily interpretable. It is important to count all pertinent costs, including capital costs and indirect costs such as management, supervision, and administration.

Once these indirect costs are known, it is likewise important to find an appropriate method to allocate them to the services ultimately provided. A simplified version of activity-based costing (ABC), based on interviews or observation of staff time, is likely to be the most practical alternative. Another key implementation issue is to ensure that the relevant benefits of these interventions are included, such as demand creation and improvements in preventive health practices.

For both planning and advocacy purposes, the results of community-level costing studies should be presented in a straightforward and easily understandable manner. Start-up costs and capital costs, to be funded by donors, should be separated from recurrent costs, which are often assumed by ministries of health or by the communities themselves.

Notes

- Thanks are due to Cathy Wolfheim, WHO, for useful comments in organizing this section.
- ² Personal communication with Akiko Maeda, the World Bank.
- The PHR package includes: immunizations, growth monitoring, vitamin A supplementation, iron supplementation, IMCI services, family planning, antenatal care, normal delivery, postnatal care, communicable diseases (sexually transmitted diseases, shistosomiasis, tuberculosis, and urinary tract infections), diabetes, hypertension, fever, first aid, and conjunctivitis.
- ⁴ However, there are estimates available of unit costs for maternal and child services delivered at the facility level. For example, Anand *et al*, (1995) estimate that the cost of fully immunizing a child is \$4.09 in public health facilities in Haryana, India. In the same study, the cost of a package of antenatal, natal, and postnatal care is calculated to be \$3.96, and family planning services per eligible couple are estimated to cost \$0.59 per year.
 - Levin *et al*, (1999) calculate the costs of providing six maternal health services at four health facilities in Uganda's Masaka District. Per delivery, antenatal care was found to cost less than \$7.00; a normal delivery cost less than \$35.00. This study includes direct and indirect (overhead) costs, but not capital costs. To allocate indirect costs, the researchers obtained data on the time allocation of personnel through interviews and through direct observation. The costs of support materials, drugs, and supplies were also allocated according to information provided by service delivery personnel in interviews.
- The difference between this figure and the \$4.09 figure for complete immunization from the study by Anand *et al*, (1995) in Haryana, India is most likely explainable by the inclusion of Ministry of Health management and support costs in the studies reviewed by Brenzel and Claquin.
- The study found that individual immunizations cost on average \$1.30 to provide; the vaccines themselves were provided without charge by the Ministry of Health. Individual community visits cost from \$1.77 to \$4.74, depending the type of staff providing these visits. Overall, preventive and promotional programs made up 6.5 percent of MaxSalud's total costs.
- Providing and treating nets costs from \$19 to \$85 in the same setting, and chemoprophylaxis (assuming existing delivery systems) cost \$3 to \$12 per DALY gained. The DALY estimates are obtained through the use of hypothetical lifetables based on assumptions about life expectancy at birth. The effectiveness data are derived from randomized controlled trials, adjusted for assumptions about the percentage of individuals who will comply with the treatment regimen.
- The estimate for ORT is clearly inconsistent with the earlier estimate of Phillips *et al*, that ORT costs \$220 per death averted (in 1982 dollars). Averting a child's death is worth a large number of DALYs 50 or more.
- Cost-effectiveness studies for community IMCI are likely to show different results than these maternal mortality studies since IMCI is more preventive in nature and requires less facility-based care than the treatment of complications arising from pregnancy and delivery.
- This study included an analysis of the costs of developing, printing, and distributing the flyers. Development costs were \$2,000, and pretesting cost an additional \$3,000. The costs of printing were just \$0.09 per flyer. Costs of distribution, which included educational seminars for community development agents, were significantly higher \$0.27 per flyer a reflection of the relatively high costs of training workshops and seminars.

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